

Chapter 15: Plant Growth and Development

NCERT Exemplar · Class 11 · Biology

Multiple Choice Questions

Question 1

Ethylene is used for

A.

Retarding ripening of tomatoes

B.

Hastening of ripening of fruits

C.

Slowing down ripening of apples

D.

Both b and c

Answer

Correct option: B

Solution

Ans: (b) Hastening the ripening of fruits

Question 2

Coconut water contains

A.

ABA

B.

Auxin

C.

Cytokinin

D.

Gibberellin

Answer

Correct option: C

Solution

Ans: (c) Cytokinin

Question 3

The affect of apical dominance can be overcome by which of the following hormone:

A.

IAA

B.

Ethylene

C.

Gibberellin

D.

Cytokinin

Answer

Correct option: D

Solution

Ans: (d) Cytokinin

Question 4

Match the following:

Column I	Column II
A. IAA	(i) Herring sperm DNA
B. ABA	(ii) Bolting
C. Ethylene	(iii) Stomatal closure
D. GA	(iv) Weed-free lawns
E. Cytokinins	(v) Ripening of fruits

Options:

- a. A – (iv), B – (iii), C – (v), D – (ii), E – (i)
- b. A – (v), B – (iii), C – (iv), D – (ii), E – (i)
- c. A – (iv), B – (i), C – (v), D – (iii), E – (ii)
- d. A – (v), B – (iii), C – (ii), D – (i), E – (iv)

Solution

Ans: (a) A – (iv), B – (iii), C – (v), D – (ii), E – (i)

Question 5

Apples are generally wrapped in waxed paper to

A.

Prevent sunlight for changing its colour

B.

Prevent aerobic respiration by checking the entry of



C.

Prevent ethylene formation due to injury

D.

Make the apples look attractive

Answer

Correct option: B

Solution

Ans: (b) Prevent aerobic respiration by checking the entry of



Explanation: The rotting of the apple will be hastened by aerobic respiration.

Question 6

Growth can be measured in various ways. Which of these can be used as parameters to measure growth

A.

Increase in cell number

B.

Increase in cell size

C.

Increase in length and weight

D.

All the above

Answer

Correct option: D

Solution

Ans: (d) All the above

Question 7

The term synergistic action of hormones refers to

A.

When two hormones act together but bring about opposite effects

B.

When two hormones act together and contribute to the same function

C.

When one hormone affects more than one function

D.

When many hormones bring about any one function

Answer

Correct option: B

Solution

Ans: (b) When two hormones act together and contribute to the same function

Question 8

Plasticity in plant growth means that

A.

Plant roots are extensible

B.

Plant development is dependent on the environment

C.

Stems can extend

D.

None of the above

Answer

Correct option: B

Solution

Ans: (b) Plant development is dependent on the environment.

Question 9

To increase sugar production in sugarcanes, they are sprayed with

A.

IAA

B.

Cytokinin

C.

Gibberellin

D.

Ethylene

Answer

Correct option: C

Solution

Ans: (c) Gibberellin

Explanation: Gibberellin lengthens the stem, increasing the quantity of sugar in the sugarcane.

Question 10

ABA acts antagonistic to

A.

Ethylene

B.

Cytokinin

C.

Gibberellic acid

D.

IAA

Answer

Correct option: C

Solution

Ans: (c) Gibberellic acid

Explanation: ABA has a growth inhibitory effect. Gibberellin, on the other hand, encourages growth.

Question 11

Monocarpic plants are those which

A.

Bear flowers with one ovary

B.

Flower once and die

C.

Bear only one flower

D.

All of the above

Answer

Correct option: B

Solution

Ans: (b) Flower once and die.

Question 12

The photoperiod in plants is perceived at

A.

Meristem

B.

Flower

C.

Floral buds

D.

Leaves

Answer

Correct option: D

Solution

Ans: (d) Leaves

Explanation: Because leaves are the primary receivers of light energy, they are also the most important players in the photoperiod.

Very Short Answer Questions**Question 1**

Fill in the blanks with appropriate word/words

a. A phase of growth which is maximum and fastest is

b. Apical dominance as expressed in dicotyledonous plants is due to the presence of more in the apical bud than in the lateral ones.

c. In addition to auxin, a must be supplied to culture medium to obtain a good callus in plant tissue cultures.

d. of a vegetative plants are the sites of photoperiodic perception.

Solution

Ans: Exponential phase

Ans: Auxin

Ans: Cytokinin

Ans: Leaves

Question 2

Plant growth substances (PGS) have innumerable practical application. Name the PGS you should use to

- a. Increase yield of sugarcane
- b. Promote lateral shoot growth
- c. Cause sprouting of potato tuber
- d. Inhibit seed germination

Solution

Ans: Gibberellic acid

Ans: Cytokinin

Ans: Ethylene

Ans: Abscissic acid

Question 3

A primary root grows from 5 cm to 19 cm in a week. Calculate the growth rate and relative growth rate over the period.

Solution

Ans. Absolute Growth rate can be calculated as follow:

$$W_1 = W_0 e^{rt}$$

Where,

$$W_1$$

is the ultimate size (weight, height, number etc.)

$$W_0$$

$$=$$

initial size at the beginning of the period

$$r$$

$$=$$

growth rate

$$t =$$

time of growth

$$e =$$

base of natural logarithms

Here,

$$r$$

is the relative growth rate

Given

$$W_1 =$$

$$19 \text{ cm}$$

$$W_0 =$$

$$5 \text{ cm}$$

$$t = 7$$

$$\text{days}$$

$$\Rightarrow 19 = 5 \times (2.7)^{r \times 7}$$

$$\begin{aligned}\Rightarrow \frac{19}{5} &= (2.7)^{r \times 7} \\ \Rightarrow 3.8 &= (2.7)^{7r} \\ \Rightarrow \log 3.8 &= 7r \times \log 2.7 \\ \Rightarrow 0.5798 &= 7r \times 0.4314 \\ \Rightarrow r &= \frac{0.5798}{7 \times 0.4314} = 0.1907\end{aligned}$$

Relative growth rate can be calculated as follows:

$$r = \frac{\text{final size}}{\text{initial size}}$$

$$\therefore r = \frac{19}{5} = 3.8 \text{ cm}$$

Absolute growth rate

$$= 0.1907$$

Relative growth rate

$$= 3.8 \text{ cm}$$

Question 4

Gibberellins were first discovered in Japan when rice plants were suffering from bakane (the foolish seedling disease) caused by a fungus *Gibberella fujikuroi*.

- Give two functions of this phytohormone.
- Which property of Gibberellin caused foolish seedling disease in rice?

Solution

Ans: Gibberellin induces bolting, i.e. growth of internode in rosette plants. Gibberellin also induces seed germination by breaking seed dormancy.

Ans: The fungus produces a lot of Gibberellin. This promotes too much growth in internodes and the plant becomes too tall to hold its own weight.

Question 5

Gibberellins promote the formation of flowers on genetically plants in Cannabis whereas ethylene promotes formation of flowers on genetically plants.

Solution

Ans: In Cannabis, gibberellins encourage the development of male flowers on genetically female plants, whereas ethylene encourages the development of female flowers on genetically prepared male plants.

Question 6

Classify the following plants into Long-Day Plants (LDP), Short Day Plants (SDP) and Day Neutral Plants (DNP): Xanthium, Henbane (*Hyoscyamus niger*), Spinach, Rice, Strawberry, Bryophyllum, Sunflower, Tomato, Maize.

Solution

Ans: Long Day Plants (LDP): Bryophyllum, Spinach, Henbane

Short Day Plants (SDP): Xanthium, Rice, Strawberry

Day Neutral Plants (DNP): Sunflower, Tomato and Maize

Question 7

A farmer grows cucumber plants in his field. He wants to increase the number of female flowers in them. Which plant growth regulator can be applied to achieve this?

Solution

Ans: Ethylene

Question 8

Where are the following hormones synthesized in plants

- a. IAA
- b. Gibberellins
- c. Cytokinins

Solution

Ans: Growing apices of plant, e.g. shoot tip, leaf primordial and developing seeds.

Ans: Apical shoot buds, young leaves, root tips and developing seeds

Ans: These are synthesized mainly in roots

Question 9

In botanical gardens and tea gardens, gardeners trim the plants regularly so that they remain bushy. Does this practice have any scientific explanation?

Solution

Ans: These plants' apical dominance prevents the formation of lateral branches. Removing the shoot apex encourages lateral development, resulting in bushier plants.

Question 10

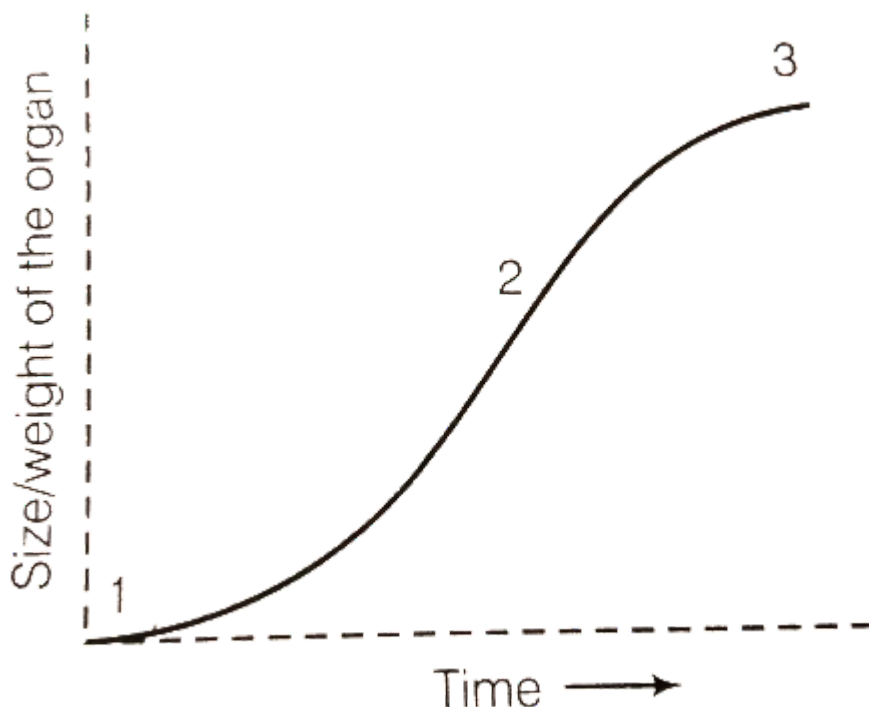
Light plays an important role in the life of all organisms. Name any three physiological processes in plants which are affected by light.

Solution

Ans: Photosynthesis, transpiration, and blooming are three physiological processes in plants that are influenced through light.

Question 11

In the figure of Sigmoid growth curve given below, label segments 1, 2 and 3.

**Solution**

Ans: (1) Lag phase, (2) Exponential phase and (3) Stationary phase

Question 12

Growth is one of the characteristic of all living organisms? Do unicellular organisms also grow? If so, what are the parameters?

Solution

Ans: Unlike multicellular organisms, unicellular organisms do not grow in size or volume. Growth in unicellular organisms is marked by mitosis which produces daughter cells. Thus, asexual reproduction by amitosis shows growth in these organisms.

Question 13

The rice seedlings infected with fungus *Gibberella fujikuroi* is called foolish seedlings? What was the reason behind it?

Solution

Ans: Rice plants which got infected with the fungus *Gibberella fujikuroi* grow excessively long. The plant's length becomes too great for it to sustain its own weight, and it eventually dies. As a result, this phenomena is known as stupid seedlings.

Short Answer Questions

Question 1

Nicotiana tabacum, a Short-Day Plant, when exposed to more than critical period of light fails to flower. Explain.

Solution

Ans: Plants that need to be exposed to light for a shorter length of time than the crucial light period are known as short day plants. Only when the photoperiod is below the critical period, i.e. when there is a continuous extended dark period, does this plant blossom. These plants do not develop blooms when exposed to a photoperiod that is longer than the crucial period. In plants, a hormone causes flowering. In response to the needed photoperiod, the hormone is found in leaves and migrates to the shoot apices.

Question 2

What are the structural characteristics of

- a. Meristematic cells near root tip
- b. The cells in the elongation zone of the root

Solution

Ans: Meristematic cells around the root tip are actively dividing. The cells are characterised by thin walls, thick cytoplasm, and a big nucleus.

Ans: The cells in this zone have a high number of tiny vacuoles. These vacuoles join together to create a single big centre vacuole. As a result, cells in this area become stretched and cause longitudinal growth.

Question 3

Does the growth pattern in plants differ from that in animals? Do all the parts of plant grow indefinitely? If not, name the regions of plant, which can grow indefinitely.

Solution

Ans: Plants grow in an unpredictably unexpected way, but mammals grow in a predictable way. This means that the bulk of plant components will keep growing eternally. However, this does not imply that all plant components continue to grow indefinitely. Only a few plant components, such as the root and shoot apices, can grow endlessly.

Question 4

Explain in 2-3 lines each of the following terms with the help of examples taken from different plant tissues:

a. Differentiation

b. De-differentiation

c. Redifferentiation

Solution

Ans: When meristematic cells become specialised for a particular function, they stop dividing. This phenomenon is called differentiation. During differentiation, cells undergo major structural changes in protoplasm and cell wall.

Ans: The living differentiated cells can regain the capability of division under suitable conditions. This phenomenon is called de-differentiation. For example; formation of meristems from fully developed parenchyma happens because of de-differentiation.

Ans: When de-differentiated cells become mature and assume specialized function once again, this is called redifferentiation. For example; cambium redifferentiates to form the cortex.

Question 5

Auxins are growth hormones capable of promoting cell elongation. They have been used in horticulture to promote growth, flowering and rooting. Write a line to explain the meaning of the following terms related to auxins.

a. Auxin precursors

b. Anti-auxins

c. Synthetic auxins

Solution

Ans: The raw materials required for initial synthesis of auxins are called auxin precursors.

Ans: Anti-auxins, such as p– chlorophenoxy isobutyric acid (PCIB) and TIBA, are compounds that block the activity of auxins.

Ans: Auxins which are made artificially are called synthetic auxins, e. g. 2,4-D, NAA.

Question 6

The role of ethylene and abscissic acid is both positive and negative. Justify this statement.

Solution

Ans: Following examples show that ethylene and abscissic acid have both positive and negative roles.

Positive Effects of Ethylene: Promotes horizontal growth. Promotes positive geotropism in stem.

Promotes apical dominance. Breaks seed and bud dormancy. Promotes fruit ripening and root initiation.

Negative Effects of Ethylene: Inhibits longitudinal growth. Enhances senescence of leaves, flowers and fruits. Prolongs dormancy of lateral buds.

Positive Effects of Abscissic Acid: Helps in reducing transpiration and thus in preventing water loss. Induces root initiation and flowering in some plants. Promotes seed dormancy and bud dormancy. Helps plants develop resistance against cold and other types of stress.

Negative Effects of Abscissic Acid: Promotes senescence of leaves. Retards cambial activity. Inhibits the function of growth hormones. Inhibits seed germination.

Question 7

While experimentation, why do you think it is difficult to assign any effect seen to any single hormone?

Solution

Ans: Plant hormones often work in combination. Some plant hormones may have antagonistic effects, while some others may have augmentative effects. It is almost impossible to pinpoint any single hormone for a particular effect in a plant part. Moreover, plant hormones bring out their effect in coordination with various extrinsic factors. Hence, it is difficult to assign any effect seen to any kind of hormone.

Question 8

What is the mechanism underlying the phenomenon by which the terminal/apical bud suppresses the growth of lateral buds? Suggest measures to overcome this phenomenon.

Solution

Ans: This phenomenon is called apical dominance. The growing shoot apex inhibits the growth of lateral branches. This happens because of a high concentration of auxins in shoot apex. To prevent apical dominance, shoot apex is trimmed. This helps auxins to move to other meristematic regions and to promote lateral branching.

Question 9

In animals, there are special glands secreting hormones, whereas there are no glands in plants. Where are plant hormones formed? How are the hormones translocated to the site of activity?

Solution

Ans: Plant hormone's are produced by individual cells; in regions where they are required by the plants. For example; auxin is synthesized in the cells of growing shoot apices. Plant hormones are translocated through the vascular system of plants. For example; auxin from the shoot apex may get mobilized to the lateral buds or flower buds. Similarly, some plant hormones may be mobilized to senescent parts.

Question 10

Many discoveries in science have been accidental. This is true for plant hormones also. Can you justify this statement by giving an example? Also, what term is used for such accidental findings?

Solution

Ans: This is true that the plant hormones have been discovered accidentally. For example; auxin was accidentally discovered by Charles Darwin and his son Francis Darwin. They observed that coleoptiles of canary grass responded to unilateral illumination by growing towards the source of light. Auxin was later isolated from coleoptiles of oat seedlings by F W Went. The term 'serendipity' is used for accidental discovery.

Question 11

To get a carpet like grass lawns are mowed regularly. Is there any of scientific explanation for this?

Solution

Ans: While mowing, the apices of grass are removed. This helps in preventing apical dominance and in preventing longitudinal growth of grass. After removal of apices, auxins get mobilized to lateral buds and promote growth of lateral branches. This helps in giving carpet-like lawns.

Question 12

In a slide showing different types of cells can you identify which type of the cell may be meristematic and the one which is incapable of dividing and how?

Solution

Ans: Different sorts of cells are depicted on a slide., presence of following characteristics would indicate meristematic cells:

- a. Thin cell wall
- b. Dense cytoplasm
- c. Cells showing cell division.
- d. Smaller vacuoles or negligible vacuoles. If above features are absent then the cells are incapable of division.

Question 13

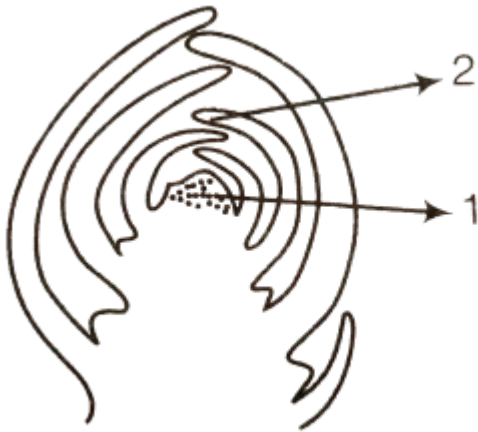
A rubber band stretches and reverts to its original position. Bubble gum stretches, but it would not return to its original position. Is there any difference between the two processes? Discuss it with respect to plant growth. [Hint: Elasticity (reversible) Plasticity (irreversible)]

Solution

Ans: From the theory of physics, we know that if a substance regains its original shape after the removal of deforming forces, the substance is said to exhibit elasticity. On the other hand, if a substance fails to regain its original shape after the removal of deforming forces, the substance is said to exhibit plasticity. In above examples; rubber band is showing elasticity. But bubble gum is showing plasticity.

Question 14

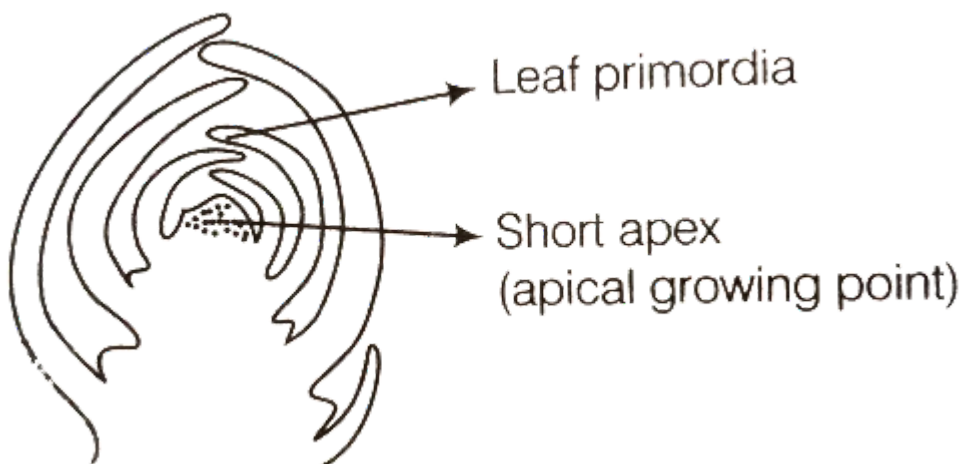
Label the diagram



- a. This is which part of a dicotyledonous plant?
- b. If we remove part 1 from the plant, what will happen?

Solution

Ans: (a) This diagram shows the shoot apex.



Ans: Removal of part 1 will prevent apical dominance. This will help in growth of lateral branches.

Question 15

Both animals and plants grow. Why do we say that growth and differentiation in plants is open and not so in animals? Does this statement hold true for sponges also?

Solution

Ans: In animals, once one type of tissue is developed, it cannot be changed into another. Furthermore, all organs of the animal's body stop growing at a specific age. Plant growth, in the other hand, is indeterminate since a plant component can develop into an unlimited number of numbers. In plants, a senescent component is frequently replaced. If a need arises, differentiated cells in plants undergo dedifferentiation. Sponges are an unusual animal in the animal realm. The growth of a sponge is open.

Question 16

Define parthenocarpy. Name the plant hormone used to induce parthenocarpy.

Solution

Ans: Parthenocarpy is a condition that occurs when fruit develops without being fertilised. Bananas and some papaya kinds are parthenocarpic fruits, meaning they don't have seeds. Parthenocarpy can be induced by auxins and gibberellins.

Question 17

While eating watermelons, all of us wish it was seedless. As a plant physiologist can you suggest any method by which this can be achieved?

Solution

Ans: Watermelons with no seeds are always preferable. Watermelons can be induced to produce seedless fruits by inducing parthenocarpy. Auxin and gibberellins can be sprayed on watermelon plants to achieve this.

Question 18

A gardener finds more broad-leaved dicot weeds growing in his lawns. What can be done to get rid of the weeds efficiently?

Solution

Ans: Spraying 2,4-D, a form of auxin, on the broad-leaved weeds will kill them. This is a synthetic auxin that farmers commonly use to control weeds.

Question 19

On germination a seed first produces shoots with leaves, flowers appear later,

- a. Why do you think this happens?
- b. How is this advantageous to the plant?

Solution

Ans: Initially, after seed germination, branches with leaves appear. This signifies the plant's vegetative development. This is necessary in order to synthesise sufficient nutrients for sexual reproduction. As a result, blossoming occurs after this stage.

Ans: The vegetative phase of growth aids in the maturation of the plant. A grown plant would be better able to tolerate the stresses of flowering and fruiting. As a result, the vegetative phase of growth aids in the survival of plant species.

Question 20

Fill in the blanks:

- a. Maximum growth is observe in phase.
- b. Apical dominance is due to
- c. initiate rooting.
- d. Pigment involved in Photoperception in flowering plants is

Solution

Ans: Exponential

Ans: Auxin

Ans: Cytokinin

Ans: Phytochrome

Long Answer Questions

Question 1

Some varieties of wheat are known as spring wheat while others are called winter wheat. Former variety is sown, and planted in spring and It is harvested by the end of the same season. However, winter varieties; if planted in spring, fail to flower or produce mature grains within a span of a flowering season. Explain, why?

Solution

Ans: In some plants, flowering is either quantitatively or qualitatively dependent on exposure to low temperature. This phenomenon is called vernalisation. For example; wheat comes in two varieties, i.e. spring wheat and winter wheat. The spring wheat is sown, and planted in spring and is harvested by the end of the same season. During this period, this variety of wheat gets the desired exposure to low temperature. But if winter variety of wheat is planted in spring; it fails to get the desired period of low temperature. As a result, the plants fail to flower or produce mature grains within a span of a flowering season.

Question 2

It is known that some varieties of wheat are sown in autumn but are harvested around next mid-summer.

- What could be the probable reason for this?
- What term is used for this promotion of flowering under low temperature?
- Which plant hormone can replace the cold treatment?

Solution

Ans: These plants germinate and grow as seedlings during winter. They resume growth during summer and finally are harvested around next midsummer. This happens because these plants are able to complete their vegetative phase of growth during winter and summer.

Ans: This process is called vernalisation.

Ans: Gibberellin hormone if given can replace the cold treatment with the same results.

Question 3

Name a hormone which

- a. is gaseous in nature**
- b. is responsible for phototropism**
- c. induces femaleness in flowers of cucumber**
- d. is used for killing weeds (dicots)**

Solution

Ans: Ethylene hormone is gaseous in nature.

Ans: Auxin hormone is responsible for phototropism.

Ans: Ethylene hormone induces female characters.

Ans: Synthetic auxin (2,4-D) is used as weedicide.

e. induces flowering in long day plants

Ans: Gibberellin hormone induces flowering in long photoperiod requiring plants.

The concepts used in NCERT for Class 11 Biology Chapter-15, Plant Growth and Development are as follows: Growth, Plant growth is generally Indeterminate, Growth is measurable, Phases of growth, Growth rates, Conditions for growth, Differentiation, Dedifferentiation, Redifferentiation, Development, Plant growth regulators - their characteristics, The discovery of plant growth regulators, Physiological effects of plant growth regulators, Photoperiodism, and Vernalisation. It is important for students to

study each of these terms in detail and understand them well. These concepts are further used in examinations of classes 11, 12, and other competitive exams.

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